MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

ECP3126- KNOWLEDGE-BASED SYSTEMS

(BE & RE)

06 MARCH 2017
2.30 PM – 4.30 PM
(2 Hours)

INSTRUCTION TO STUDENTS

1. This question paper consists of 6 pages including cover page with 5 questions only.

2. Attempt **ALL** the **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided.

Question 1

(a) Draw the general block diagram of knowledge-based systems and explain the role of knowledge engineer in building a knowledge-based system. Mention any two advantages of expert systems over human experts.

[8 marks]

(b) Identify the three important differences between the traditional software development life cycle and the expert system software development life and explain the reason.

[6 marks]

(c) Write the predicate logic expression for the following information.
"at least one or more teachers would have studied bachelor degree in engineering and masters degree in management"

[2 marks]

(d) Recommend a suitable search algorithm for an expert system designed for Global Positioning System (GPS). Is your recommendation is from heuristic search or from blind search category? Justify your answer.

[4 marks]

Continued...

Question 2

(a) Nowadays, especially in Japan manufacturers use fuzzy logic in everything from cameras to industrial process control. What are the two main reasons for this trend?

[2 marks]

(b) Explain the stages in the design of a fuzzy logic controller to control the supply of power to the compressor of a freezer whose operational conditions are given below. The ideal temperature of the freezer is 0 degrees centigrade, while the variation in internal temperature is not expected to be more than +5 or -5 degrees. The maximum rate of change of temperature is expected to be within +2 or -2 degrees per hour. The compressor is expected to be powered in the range of 0 to 2 kW.

[10 marks]

(c) Identify the input and output of each block shown in Figure Q2c which represents the basic architecture of a typical fuzzy expert system.

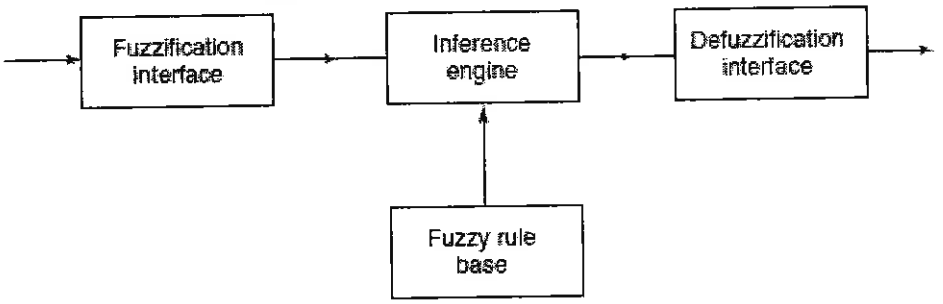


Figure Q2c.

[4 marks]

(d) Analyze how the weekend-ness is presented in the following plots shown in Figure Q2d(i) and Figure Q2d(ii).

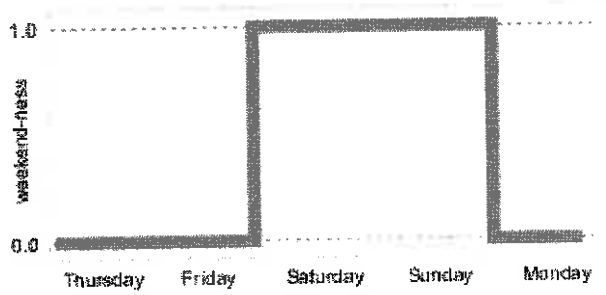


Figure Q2d(i)

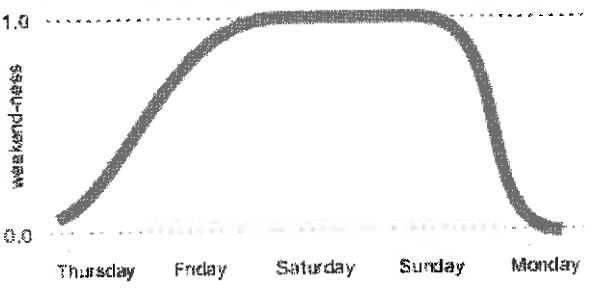


Figure Q2d(ii)

[4 marks]

Continued...

Question 3

(a) Justify the following statement with your own example.
"Computer is so good in the area where human brain is weak, at the same time; Human brain is so good in the area where computer is weak".

[3 marks]

(b) Explain why XOR gate cannot be modeled by a single layer perceptron?

[5 marks]

(c) i.
Draw the architecture of McCulloch-Pitts neurons network model that can perform the logic function represented by the following truth table and verify your model mathematically.

Input 1	Input 2	Output
1	1	0
1	0	1
0	1	1
0	0	0

[7 marks]

ii.
Name and write the suitable activation function for the neural network constructed in Question 3(c)(i).

[3 marks]

(d) Identify the kind of problems that can be solved by using supervised learning algorithms and also identify the kind of problems that can be solved by using unsupervised learning algorithms.

[2 marks]

Continued...

Question 4

(a) The network shown in Figure Q4a, when properly trained, should respond with $\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} 0.6 \\ 0.2 \end{bmatrix}$

to the augmented input pattern $\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$

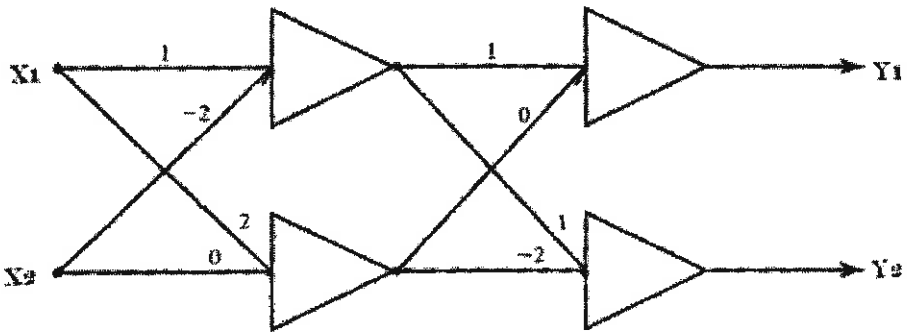


Figure Q4a.

The networks weight have been initialized as shown in the figure. Analyze a single feed-forward and back-propagation step for the initialized network by doing the following:

(i) Find the weight matrices WH and WO of hidden and output layers respectively.

[2 marks]

(ii) Calculate VH (the total input to hidden layer) and YH (the output of the hidden layer).

[2 marks]

(iii) Calculate VO (the total input to output layer) and Y (the calculated output of the output layer).

[2 marks]

(iv) Calculate the ∇ WO (the small change in the output layer neurons weight).

[2 marks]

(v) Find the updated weights for output layer neurons.

[2 marks]

For computations assume Sigmoid function $\varphi(v) = \dfrac{1}{1+e^{-\alpha v}}$ with α equals to 1 and the learning rate η=1.

(b) Explain why BPN cannot extrapolate.

[2 marks]

Continued...

(c) Design a neural network for classifying the following two dimensional input vectors P1, P2, P3 and P4 into two separate groups.

	P1	P2	P3	P4
X	0.3	0.7	0.2	0.9
Y	0.3	0.7	0.2	0.9

Draw the architecture of the network. Recommend a suitable learning algorithm to be used for training your neural network, with justification. Draw a X-Y graph showing these training vectors and the position of the output neurons after being trained.

[8 marks]

Question 5

(a) Consider a bidirectional associative memory (BAM) network (with bipolar vectors) to map two simple letters (given by 5 x 3 patterns) to the following bipolar target codes:

pattern (E) (−1, 1)

pattern (H) (1, 1)

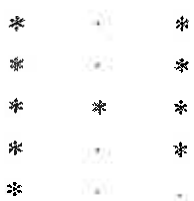
(i) Find the weight matrix with input pattern E and H. While encoding the given 5 x 3 input pattern use row major ordering with "*" be marked as 1 and "." be marked as -1. To store E, the target is (-1 1) and to store H, the target is (1, 1).

[4 marks]

(ii) Obtain the response of the BAM network with E and H as input.

[4 marks]

(iii) Also, test the performance of the net when the following noisy version of input pattern H is presented.



[4 marks]

(b) Discuss the main shortcoming of BAM with respect to human memory. Which model or type of Artificial Neural Network can overcome this shortcoming? Explain with a simple block diagram how it is achieved in that model or type.

[8 marks]

End of paper